

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Customer No.
RYU et al.	:	26817
	:	
Serial No. 10/586,931	:	Group Art Unit: 1795
	:	
Filed: July 21, 2006	:	Examiner: Amanda J. BARROW
	:	
Title: NAS BATTERY USING LIQUID	:	Confirmation No. 8187
ELECTROLYTE	:	
	:	
	:	x

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Commissioner for Patents  
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Alexandria, VA 22313-1450

**DECLARATION OF Hyo-Jun Ahn**  
**SUBMITTED UNDER 37 CFR 1.132**

Sir:

I, Hyo-Jun Ahn, hereby declare as follows:

1. I have a Bachelor of Metallurgy degree from Yonsei University and am an inventor of the above described application.
2. I have reviewed the above described application and the cited reference U.S. Patent Publication No. 2001/0033971 to Zhao et al.
3. Sulfur is a chemical element that has the atomic number 16 and the atomic weight 32.066g/mol and has the following physical properties which are described in Wikipedia and attached hereto as:

Physical properties	
Phase	solid
Density (near r.t.)	(alpha) 2.07 g·cm <sup>-3</sup>
Density (near r.t.)	(beta) 1.96 g·cm <sup>-3</sup>
Density (near r.t.)	(gamma) 1.92 g·cm <sup>-3</sup>
Liquid density at m.p.	1.819 g·cm <sup>-3</sup>
Melting point	388.36 K, 115.21 °C, 239.38 °F
Boiling point	717.8 K, 444.6 °C, 832.3 °F
Critical point	1314 K, 20.7 MPa
Heat of fusion	(mono) 1.727 kJ·mol <sup>-1</sup>
Heat of vaporization	(mono) 45 kJ·mol <sup>-1</sup>
Specific heat capacity	(25 °C) 22.75 J·mol <sup>-1</sup> ·K <sup>-1</sup>

4. The CS compound recited in Zhao et al. has the following physical properties, which are described in Wikipedia and Zhao et al. at ¶¶ [0049], [0093] and [0094]:

Properties of Polycarbon sulfide	
Molecular formula	-Sm- (m≧3)
Boiling point	(CS <sub>4.9</sub> ) <sub>n</sub> : 122.7 °C, (CS <sub>1.06</sub> ) <sub>n</sub> : 314 °C
Electrical conductivity	(CS <sub>4.9</sub> ) <sub>n</sub> : less than 10-11S/cm, (CS <sub>1.06</sub> ) <sub>n</sub> : 5×10-7 S/cm (CS <sub>2.6</sub> ) <sub>n</sub> : 2.047 g/cm <sup>3</sup> ,
Density ( 25°C)	(CS <sub>1.06</sub> ) <sub>n</sub> : 1.903 g/cm <sup>3</sup>
Weigth loss : 5% or less from R.T to 300 °C	
Excellent thermal stability, high crystallinity	

Properties of CS <sub>2</sub>	
Molecular formula	CS <sub>2</sub>
Molar mass	76.139 g/mol
Appearance	colorless liquid impure: light-yellow
Density	1.261 g/cm <sup>3</sup>
Melting point	-110.8 °C, 162 K, -167 °F
Boiling point	46.3 °C, 319 K, 115 °F
Solubility in water	0.29 g/100 g (20 °C)
Refractive index (n <sub>D</sub> )	1.6295

5. The positive electrode of claim 1 of the present invention is a sulfur electrode, whereas the positive electrode of Zhao et al. is a CS electrode.

6. Referring to Fig. 2 of the present application, the Na/S battery recited in claim 1 of the present invention has a reaction voltage of 2.18V and 1.7V and a capacity of 663 mAh/g.

7. The theoretical capacity of sulfur is 1675 mAh/g and the theoretical capacity of polycarbon sulfide is 550-890 mAh/g, and thus they have different ranges.

8. Accordingly CS and S are different materials and have different properties.

9. Zhao et al. do not disclose or suggest any detailed experiment or properties relating to the Na/CSn battery and do not disclose the invention defined by the present claims.

10. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and, further, that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing therefrom.

Dated: June 24, 2010

By: 

Name: Hyo-Jun Ahn